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Comtois et al.

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[54] **PROTECTION CUTTING APPARATUS PROVIDED WITH AN ARC BREAKING SCREEN**

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[51] **Int. Cl.**[4] **H01H 33/06;** H01H 9/32

[52] **U.S. Cl.** **200/151**

[58] **Field of Search** 200/151

[56] **References Cited**

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[57] **ABSTRACT**

Electromechanical protection cutting apparatus comprising a magnetic tripping device and an arc-breaking screen which may be interleaved between at least one fixed contact and one movable contact during an opening caused by the tripping device. The stop (**24**) associated with the casing (**11**) of the apparatus to receive the breaking screen (**12**) is deformable and so arranged as not to restore immediately to the screen the kinetic energy received therefrom.

7 Claims, 1 Drawing Sheet

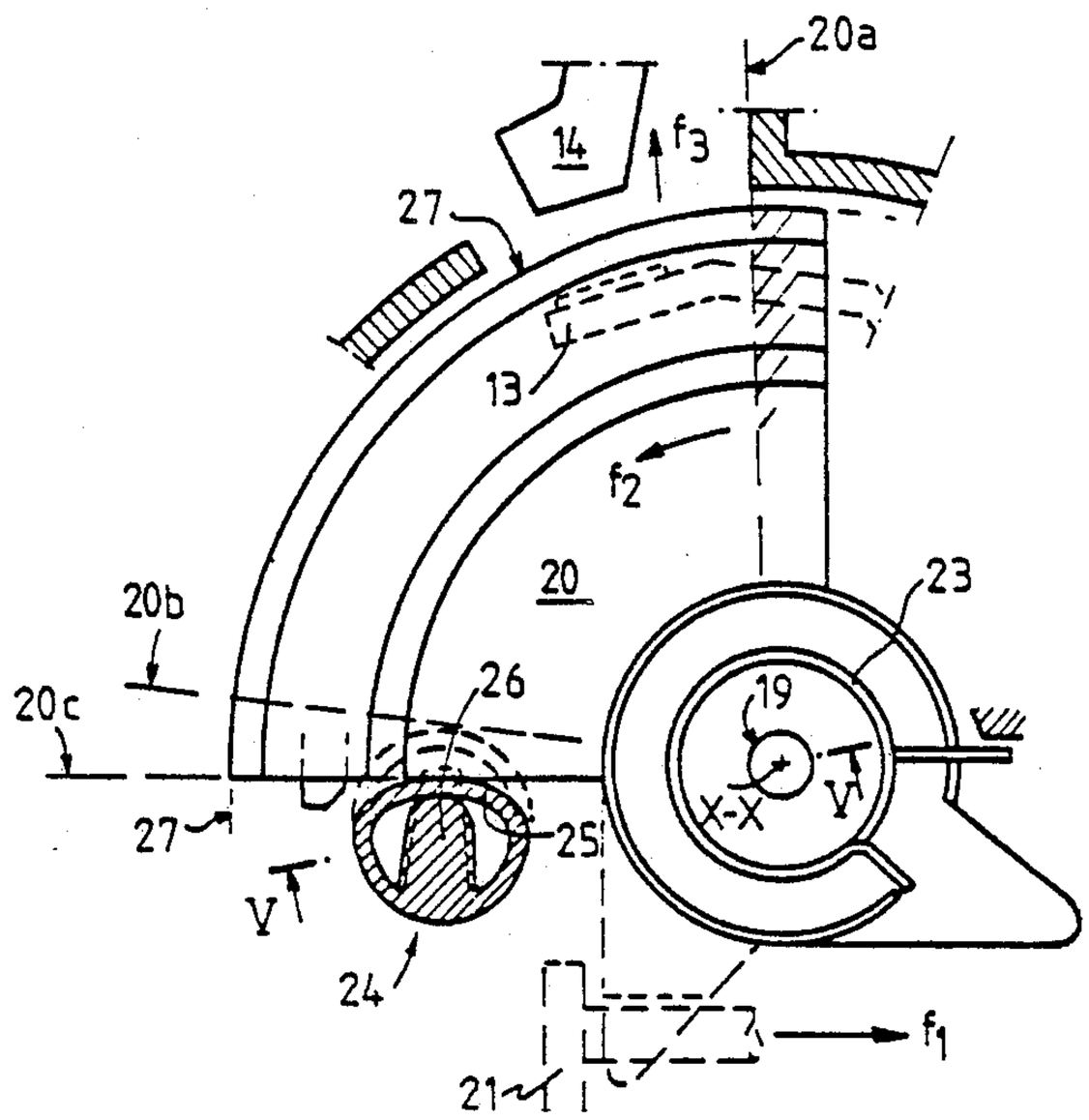

FIG. 1

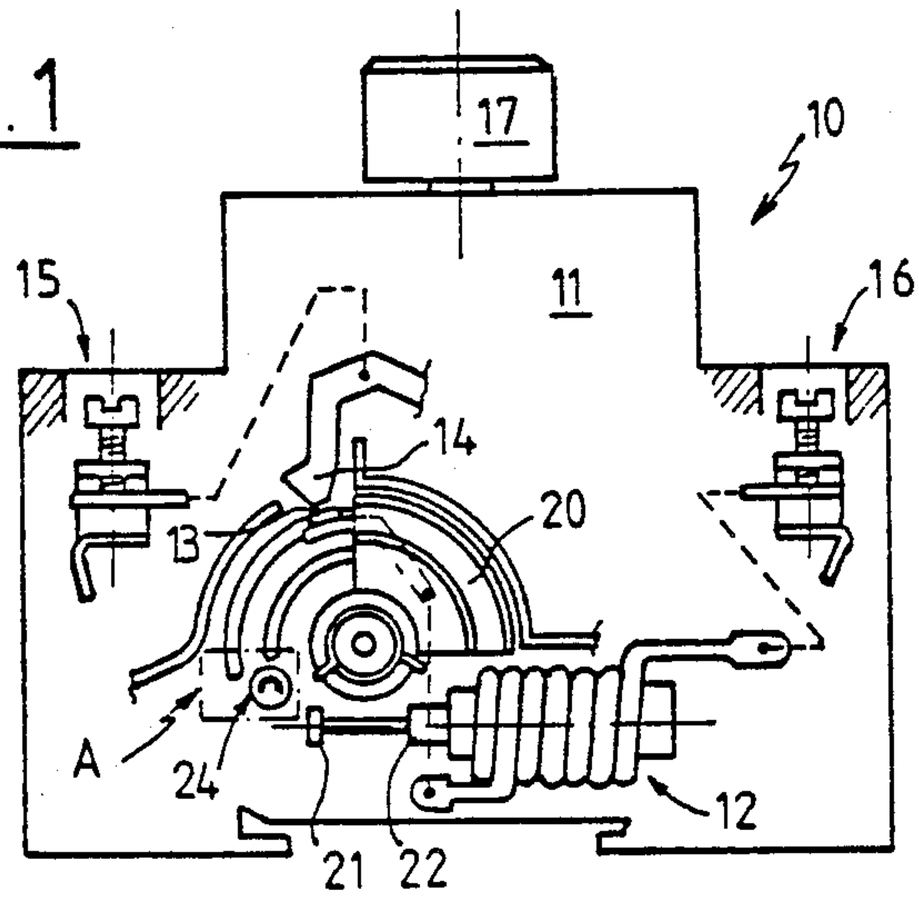

FIG. 2

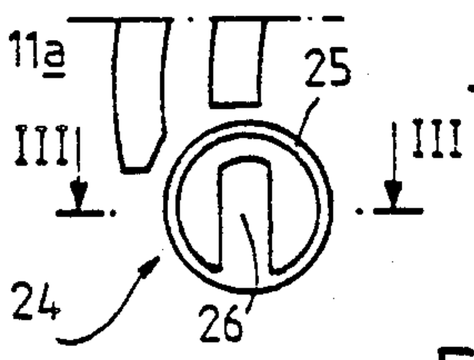

FIG. 5

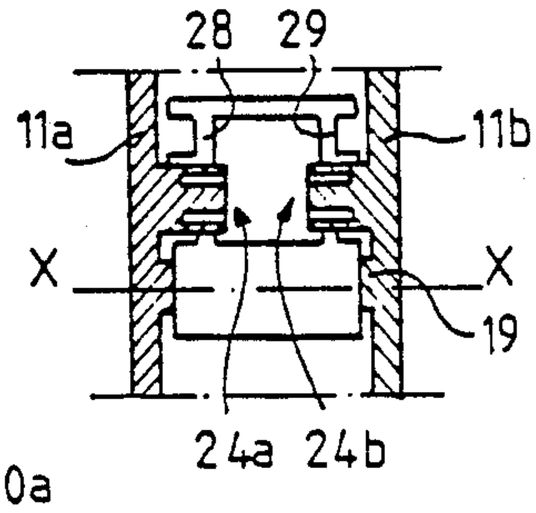

FIG. 3

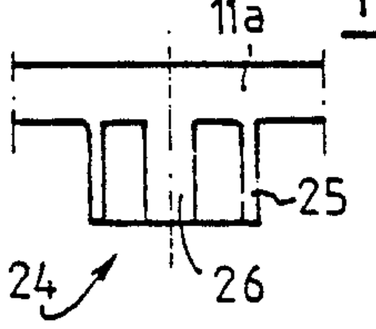

FIG. 4

PROTECTION CUTTING APPARATUS PROVIDED WITH AN ARC BREAKING SCREEN

The present invention relates to an electromechanical protection switching apparatus with current threshold.

Such a switching apparatus is described in French Pat. No. 2 563 939. It includes in a case a breakable electric circuit which includes a magnetic trip, at least on separable fixed contact and mobile contact, as well as an arc breaking screen interposable between the contacts during a separation thereof caused by the actuation of the magnetic trip in response to an overcurrent or a short circuit. In French Pat. No. 2 540 665, such a device is also described in which the screen has a front surface able to be applied at the end of travel against a stop of the case.

Such switching apparatus operate satisfactorily. However, it can be observed that the arc breaking screen is projected at high speed towards its stop by the plunger of the magnetic trip. It reaches its stop with a very high speed, sometimes greater than 20 m/s and with keen acceleration capable of exceeding 400 g. This is observed particularly at the periphery of rotary breaking screens.

The screen risks then either breaking the stop or being itself broken. If the screen and/or its stop are reinforced, the screen risks bouncing and letting the arc phenomenon continue to exist, which adversely affects the operation of the apparatus and its lifespan. In addition, such reinforcement causes an increase of size, which is undesirable in the case of modular apparatus.

The purpose of the invention is to overcome these drawbacks and to prevent the continuation of the arc phenomenon as soon as this latter has been destabilized by the breaking screen, using simple, compact and efficient means. It also aims at integrating these means simply in the case of the apparatus. In accordance with the invention, the stop associated with the case for receiving the breaking screen is deformable. The stop is preferably at least partly resilient and adapted so as not to restore immediately to the breaking screen the kinetic energy received therefrom, the delay in restoring this energy being determined so that return of the screen only takes place after total extinction of the arc.

The stop may advantageously be attached to a part of the case of the apparatus and be integrally molded therewith; to balance the reaction on the screen, two deformable stops are preferably provided disposed opposite each other on two mutually assemblable parts of the case.

The deformable stop may have at least two zones of different resilience, the zone of highest resilience receiving the impact of the screen and being applied on the zone of lower resilience, so as to ensure a graduated deceleration of the screen. When the breaking screen is of the rotary type, the stop is preferably disposed between the periphery of the screen and the axis of rotation thereof, while being close to the striking center of the screen, so as to attenuate the reaction on the pivots of the screen.

Other features and advantages of the invention appear in greater detail from the following description.

In the accompanying drawings:

FIG. **1** shows schematically, in elevation, a switching apparatus having an arc breaking screen and a deformable screen stop in accordance with the invention;

FIG. **1** shows, on a larger scale, the detail A of FIG. **1**;

FIG. **3** is a sectional view through III—III of FIG. **2**;

FIG. **4** shows on a larger scale the crushing of the stop by the screen; and

FIG. **5** is a partial section through the plane V—V of FIG. **4**.

The switching apparatus **10** shown in FIG. **1** is an isolating cut-out switch including a case **11** and, in this case, a breakable electric circuit which includes a magnetic trip **12**, as well as a fixed contact **13** and a mobile contact **14**. Apparatus **10**, which could also be a contact breaker or contact maker-breaker, controls an external circuit capable of being connected to terminals **15**, **16**. The current flows, for example, from terminal **15** to terminal **16** through the mobile contact **14**, the fixed contact **13** and the trip **12** via the connections shown with broken lines. Trip **12** acts on the mobile contact **14** via a lock, not shown, whereas a button or lever **17** makes it possible to open the contacts manually or to reset them. A thermal trip may also be provided for acting on the lock.

A breaking screen **20** made from insulating material is mounted for rotation on pivots **19** with axis X—X in the case **11**, (see FIGS. **4** and **5**). Such a screen is described in French Pat. No. 2 563 939 and it may be actuated directly or indirectly by the magnetic trip **12** to come between the fixed **13** and mobile **14** contacts so as to contribute to drawing out, cooling and destabilizing the breaking arc. In the present embodiment, it is a question of direct drive by a tail **21** of the plunger **22** of trip **12**.

The breaking screen **20** normally occupies a rest position **20***a* (FIG. **1** and in broken lines in FIG. **4**) towards which it is returned by a torsion spring **23** and it is propellable by tail **21** of the magnetic trip **12** towards a resiliently deformable stop **24**. Screen **20** reaches the stop in a contact making position **20***b* (FIG. **4**) at a speed of the order of 20 m/s and with an acceleration greater than 200 g; it crushes the stop to reach the position **20***c* (FIG. **4**). The respective movements of parts **21**, **20** and **14** during opening are shown by the arrows f_1, f_2, f_3 in FIG. **4**.

Stop **24** is formed of a zone with relatively high resilience formed by a thin annular dividing wall **25** and a zone of relatively low resilience—or relatively rigid zone—formed by a solid stop **26**. In the present example, the dividing wall **25** is attached to the foot of stop **26** so as to bend and be crushed thereon for compressing it as shown in FIG. **4**. Zones **25**, **26** could of course be disposed and arranged differently, so as to make a progressive deceleration of the screen possible in all cases and restoral thereto of its striking energy with a given delay guaranteeing that the return of the screen under the combined effect of this energy and that of the return spring **23** will only take place once the arc is extinguished.

The deformable stop **24** is preferably disposed between the periphery **27** of screen **20** and the axis X—X close to the striking center of the screen so as to attenuate the reaction on pivots **19**.

The case may be formed of two mutually assemblable parts whose walls **11**a, **11**b are provided during molding with respective resiliently deformable stops **24***a*, **24***b* facing each other. The deformable stops cooperate with edges **28**, **29** of the screen, substantially parallel to the walls **11***a*, **11***b* forming a part of the front surface of the screen.

It goes without saying that modifications may be made to the embodiment described. Thus, the invention applies to switching apparatus with rectilinear moving arc breaking screens. The propulsion energy for the screen may, in some cases, be supplied by a resettable accumulator mechanism actuated by the magnetic trip.

What is claimed is:

1. Protection switching apparatus with current threshold including in a case (**11**) a breakable electric circuit which includes a trip (**12**), at least one fixed contact (**13**) and one mobile contact (**14**) which are separable, as well as an arc breaking screen (**20**) insertable between the contacts during a separation thereof caused by the actuation of the trip, the screen having a front surface capable of being applied at the end of travel against a stop (**24**) associated with the case, characterized by the fact that said stop (**24**) has at least two zones of different resilience, the breaking screen being applied in its breaking travel initially on the zone of highest resilience.

2. Apparatus according to claim **1**, characterized by the fact that the stop (**24**) is directly attached to a part of the case (**11**) and integrally molded with this part.

3. Apparatus according to claim **1**, characterized by the fact that two deformable stops (**24***a*, **24***b*) are provided situated opposite each other on the walls (**11***a*, **11***b*) of two mutually assemblable parts of the case (**11**).

4. Apparatus according to claim **3**, characterized by the fact that the zone of highest resilience (**25**) of the stop is formed by an annular dividing wall of small thickness, whereas the zone of lowest resilience (**26**) of the stop is formed by a solid part, so that the annular dividing wall (**25**), when it is crushed by the screen (**20**), comes to bear on the solid part (**26**).

5. Apparatus according to claim **1**, characterized by the fact that the arc breaking screen (**20**) is of the rotary type and the resiliently deformable stop (**24**) is disposed between the periphery of the screen and the axis of rotation thereof so as to be situated close to the striking center of the screen.

6. Apparatus according to claim **3**, characterized by the fact that the zone of highest resilience (**25**) of the stop is formed by an annular dividing wall of small thickness, whereas the zone of lowest resilience (**26**) of the stop is formed by a solid part, so that the annular dividing wall (**25**), when it is crushed by the screen (**20**), comes to bear on the solid part (**26**).

7. Apparatus according to claim **6**, characterized by the fact that the arc breaking screen (**20**) is of the rotary type and the resiliently deformable stop (**24**) is disposed between the periphery of the screen and the axis of rotation thereof so as to be situated close to the striking center of the screen.

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